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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/849,571	05/20/2004	Weidong Zhu	266923-000007USPT	6579

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EXAMINER	
NGHIEM, MICHAEL P	

ART UNIT	PAPER NUMBER
2857	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/849,571	ZHU ET AL.	
	Examiner	Art Unit	
	MICHAEL NGHIEM	2857	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 June 2011*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *47,49,56-60 and 62-65* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *47,49,56-60 and 62-65* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/GB/08) Paper No(s)/Mail Date _____
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

In view of the Appeal Brief filed on June 20, 2011, PROSECUTION IS HEREBY REOPENED. A new ground of rejection is set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

(1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,

(2) initiate a new appeal by filing a notice of appeal under 37 CFR 41.31 followed by an appeal brief under 37 CFR 41.37. The previously paid notice of appeal fee and appeal brief fee can be applied to the new appeal. If, however, the appeal fees set forth in 37 CFR 41.20 have been increased since they were previously paid, then appellant must pay the difference between the increased fees and the amount previously paid.

A Supervisory Patent Examiner (SPE) has approved of reopening prosecution by signing below:

/Eliseo Ramos-Feliciano/
Supervisory Patent Examiner, Art Unit 2857.

Withdrawal of Allowability

The indicated allowability of claims 59 and 62-65 is withdrawn in view of the new grounds of rejection as follow.

Claim Objections

Claim 56 is objected to because of the following informalities: "a structure" (line 3) should be – the structure --. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 47, 49, and 60 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 47, 49, and 60, it is unclear whether the "number of the stiffness parameters is larger than a number of system equations such that the system equations are severely underdetermined" in view of the specification. The specification defines severely underdetermined system equations as having 5 equations with 80 unknowns (see USPGPUB 2005/0072234, paragraph 0188, lines 22-24). The specification describes system equations (5) and (6), each system equation has plural stiffness parameters (Gi's) (paragraph 0075). However, paragraph 0075 does not disclose 5 system equations and 80 stiffness parameters. The specification further describes that the system equations (5) and (6) are either determinate, under-determined, or over-

determined (paragraph 0130, lines 21-25). However, paragraph 0130 does not describe that the system equations (5) and (6) are severely underdetermined.

Claims 47, 49, and 60 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: the relationship between the system equations and the system for determining stiffness parameters. Besides being less than the number of stiffness parameters, the system equations are not related to the system for determining stiffness parameters.

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 47, 49, and 60 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. "... a number of stiffness parameters is larger than a number of system equations such that the system equations are severely underdetermined" is not described in the original disclosure.

The specification defines severely underdetermined system equations as having 5 equations with 80 unknowns (original specification, paragraph 0099, last two lines). The specification describes system equations (5) and (6) (2 system equations), each system equation has plural stiffness parameters (Gi's) (original specification, paragraph 0067). However, paragraph 0067 does not disclose 5 system equations having 80 stiffness parameters. The specification further describes that the system equations (5) and (6) are either determinate, under-determined, or over-determined (original specification 0074, lines 14-17). However, paragraph 0074 does not describe that the system equations (5) and (6) are severely underdetermined. Accordingly, the original specification does not describe "... a number of stiffness parameters is larger than a number of system equations such that the system equations are severely underdetermined".

Claims 47, 49, and 60 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The limitation of "an iterative processing unit that determines said stiffness parameters ... wherein a number of stiffness parameters is larger than a number of system equations such that the system equations are severely underdetermined" was not described in the specification in such a way as to enable one skilled in the art to

which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The specification discloses that there are generally an infinite number of solutions when the system equations are under-determined (USPGPUB 20050072234, paragraph 0135, lines 4-5). The specification discloses while the optimization methods are introduced for over-determined systems, they can be used for under-determined systems (paragraph 0137, lines 8-10). However, the specification further discloses that, for under-determined systems, $J = 0$, $e\lambda = 0$, and $e\Phi = 0$ (paragraph 0137, lines 8-10). Substituting these parameters of 0 value into equation (35) would result in: $0 = 0 + 0$. Accordingly, one skilled in the art would not be able to make and/or use equation (35) of the invention to determine the stiffness parameters.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 56-59 and 62-65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stubbs.

Regarding claims 56, 59, and 62, Stubbs discloses a system for determining stiffness parameters of a structure (Fig. 5), comprising:

a structure (structure, Abstract, line 1; specimen 42);

a random impact device (impact hammer, column 5, line 51) for introducing vibrations in said structure (column 5, lines 50-53), comprising:

a random impact actuator (body of impact hammer, column 5, line 51); and

a random impact applicator coupled to said random impact actuator (impact hammer has impact surface), wherein said random impact actuator drives said impact applicator (impact hammer drives impact surface to impact specimen 42) such that force (40) and arrival times of said impact applicator at said structure (42) are random (column 22, lines 18-20; column 5, lines 50-53; column 6, lines 58-60);

a sensor (claim 1, line 4; 46, Fig. 4a) arranged to measure vibrations of said structure (claim 1, lines 4-5) and output vibration information (measured first signal, claim 1, lines 4-5; column 6, lines 22-25); and

a parameter unit for receiving said vibration information (column 6, lines 41-44; column 1, lines 56-58; column 25, lines 31-34; 104, Fig. 5), determining natural frequency data of said structure (column 6, lines 41-46),

However, regarding claims 56, 59, and 62, Stubbs does not explicitly disclose a random signal generating unit for generating first and second outputs to the random impact actuator.

Stubbs discloses that the random impact device is a PCB 086B01 hammer (column 5, line 51). It would be obvious to electrically actuate the PCB impact device with electric signals (+/-) since the device is an electrical device (see Google Search of PCB 086B01, paragraph 4, page 2).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to provide the impact device of Stubbs with a random signal generating unit for the purpose of electrically actuating the PCB impact device.

Regarding claims 56, 59, and 62, Stubbs further does not explicitly disclose a stiffness parameter unit that determines the stiffness parameters of said structure using said natural frequency data.

Stubbs discloses a relationship between natural frequencies (ωn) and stiffness (E) (using equation 1, column 5, which expresses the relationship between natural frequencies and stiffness). Stubbs further discloses stiffness (loss) may be determined using non-destructive vibration measurement techniques (column 1, lines 55-58).

Accordingly, it would be obvious to provide a stiffness parameter unit that determines the stiffness parameters of said structure using said natural frequency data.

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to provide Stubbs with a stiffness parameter unit for the purpose of determining the stiffness parameters of said structure using said natural frequency data.

Regarding claims 57, 59, and 63, Stubbs discloses said random impact actuator drives said impact applicator (impact hammer PCB 086B01 drives impact surface to excite specimen).

Stubbs does not explicitly disclose said impact applicator is driven in accordance with said first and second outputs.

As discussed above, it would be obvious to provide a random signal generator to drive the impact applicator (impact surface) with the PCB impact hammer in accordance with said first and second outputs.

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to provide Stubbs with a random signal generator for the

purpose of driving the impact applicator in accordance with said first and second outputs.

Regarding claims 58, 59, and 64, Stubbs does not disclose the first and second outputs comprise independent random variables.

Stubbs discloses applying burst random excitation forces (column 22, lines 18-20). It would be obvious to supply, via the random signal generator, the random impact device (impact hammer) with any power signal that is adequate to operate the random impact device. The independent random variables are described in the instant specification as "any signal or signals that ultimately results in random impact actuator 1570 driving impact applicator 1580 to impact structure 1600 with random arrival times and random amplitudes" (USPGPUB 2005/0072234, paragraph 0231, lines 4-7).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to provide Stubbs with a random signal generator for the purpose of supplying the random impact device with any power signal that is adequate to operate the random impact device.

Regarding claims 59 and 65, Stubbs does not explicitly disclose the first and second outputs determine the force and arrival times, respectively, of the impact applicator at said structure.

As discussed above, it would be obvious to provide a random signal generator to drive the impact applicator (impact surface) with the PCB impact hammer using said first and second outputs. Accordingly, the first and second outputs determine the force and arrival times, respectively, of the impact applicator at said structure to the extent that the random signal generator sends the electric power to generate the force and arrival times of the impact applicator.

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to provide Stubbs with a random signal generator for the purpose of sends the electric power to generate the force and arrival times of the impact applicator at said structure. Accordingly, the first and second outputs determine the force and arrival times, respectively, of the impact applicator at said structure.

Response to Arguments

Applicant's arguments filed on June 20, 2011 have been fully considered but they are not persuasive.

With respect to the 35 USC 112, 2nd paragraph, rejections of claims 47, 49, and 60, Applicants argue that "claims 47, 49, and 60 particularly point out and distinctly claim the subject matter which the Appellants regard as the invention, as disclosed in Appellant's disclosure". "Regarding the claim language 'a number of said stiffness

parameters is larger than a number of system equations such that the system equations are severely underdetermined,' one of ordinary skill would refer, by way of example, to the 'system equations' (5) and (6), which are referred to in numerous contexts throughout Applicants' specification (see, e.g., paragraphs [0130], [0160], [0163], [0173], [0174], [0182], [0188], [0208], [0211], [0215], [0216], and [0220])". " Continuing, paragraph [0130] states that '[t]he system equations in Eqs. (5) and (6) involves nλ + nφNm scalar equations with m unknowns, which are in general determinate if nλ + nφNm = m, under-determined if nλ + nφNm < m, and over-determined if n~ + nλ + nφNm > m' ". "Stated differently, for a linear system having m equations and n unknowns, the system is "underdetermined" if n > m (and is "overdetermined" if m > n). Severely underdetermined system of linear equations include systems wherein n >> m (i.e., far more unknowns than equations, where n represents unknowns and m represents equations).

Examiner's position, as discussed above, is that the "number of the stiffness parameters is larger than a number of system equations such that the system equations are severely underdetermined" is not definite in view of the specification. The specification defines severely underdetermined system equations as having 5 equations with 80 unknowns (see USPGPUB 2005/0072234, paragraph 0188, lines 22-24). The specification describes system equations (5) and (6), each system equation has plural stiffness parameters (Gi's) (paragraph 0075). However, paragraph 0075 does not disclose 5 system equations and 80 stiffness parameters. The specification further describes that the system equations (5) and (6) are either determinate, under-

determined, or over-determined (paragraph 0130, lines 21-25). However, paragraph 0130 does not describe that the system equations (5) and (6) are severely underdetermined. Thus, in view of the specification, it is unclear whether the "number of the stiffness parameters is larger than a number of system equations such that the system equations are severely underdetermined".

With respect to the 35 USC 112, 1st paragraph (failing to comply with the written description), rejections of claims 47, 49, and 60, Applicants argue "[b]y way of example, paragraph [0130] of Appellant's specification states that the system equations in Eqs. (5) and (6) involves $n\lambda + n\varphi Nm$ scalar equations with m unknowns, which are, in general determinate, if $n\lambda + n\varphi Nm = m$, under-determined if $n\lambda + n\varphi Nm < m$, and over-determined if $n\lambda + n\varphi Nm > m$. A system of linear equations is considered over-determined if there are more equations than unknowns, whereas an under-determined system of linear equations has more unknowns than equations (see, e.g., paragraph [0188] describing a scenario with a severely underdetermined system)". Applicants argue that the specification "discusses an example of an aluminum beam test specimen (see FIG. 12) with '*severely underdetermined system equations* (5 equations with 80 unknowns)." (paragraph [0188]).

Examiner's position, as discussed above, is that the specification defines severely underdetermined system equations as having 5 equations with 80 unknowns (original specification, paragraph 0099, last two lines). The specification describes system equations (5) and (6) (2 system equations), each system equation has plural stiffness parameters (Gi's) (original specification, paragraph 0067). However, paragraph

0067 does not disclose 5 system equations and 80 stiffness parameters. The specification further describes that the system equations (5) and (6) are either determinate, under-determined, or over-determined (original specification 0074, lines 14-17). However, paragraph 0074 does not describe that the system equations (5) and (6) are severely underdetermined. Accordingly, the original specification does not describe the "number of stiffness parameters is larger than a number of system equations such that the system equations are severely underdetermined".

With respect to the 35 USC 103 rejections, Applicants argue that "Stubbs has not been shown to disclose or suggest a random impact device comprising (1) a random signal generating unit for generating first and second outputs, (2) a random impact actuator for receiving said first and second outputs, and (3) an impact applicator coupled to said random impact actuator, wherein (4) said random impact actuator drives said impact applicator such that force and arrival times of said impact applicator at said structure are random". "Stubbs also fails to disclose that the random impact actuator drives the impact applicator in accordance with the first and second outputs from the random signal generating unit (claim 57). Stubbs also fails to disclose that, further to claim 57, 'the first and second outputs comprise independent random variables'."

Examiner's positions with respect to the 35 USC 103 rejections have been addressed above.

Applicants further argue that "Stubbs, in fact, actually teaches away from Appellants disclosure and claims, stating that 'the response functions illustrated in plots

67a-b are unaffected by variations in the input force and duration of excitation applied to the structure.' (col. 6, lines 57-60, cited by the Examiner)(emphasis added)".

Applicants appear to argue that Stubbs does not teach a random impact device that drives an impact applicator such that the force and arrival times of the impact applicator at said structure is random.

Examiner's position is that Stubbs discloses applying burst random excitation forces (column 22, lines 18-20). It would be obvious to supply, via the random signal generator, the random impact device (impact hammer) with any power signal that is adequate to operate the random impact device. The independent random variables are described in the instant specification as "any signal or signals that ultimately results in random impact actuator 1570 driving impact applicator 1580 to impact structure 1600 with random arrival times and random amplitudes" (USPGPUB 2005/0072234, paragraph 0231, lines 4-7).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Brombolich (US 2003/0222871) discloses an iteration process for evaluating stiffness (paragraph 0068, lines 1-5).

Abu El Ata et al. (US 2004/0249482) discloses a first order perturbation approach (paragraph 0070).

Lu (US 2003/0012263) discloses a symbol amplitude approximation using first order perturbation (paragraph 0058, lines 1-18).

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Nghiem whose telephone number is (571) 272-2277. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew Dunn can be reached on (571) 272-2312. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Michael P. Nghiem/

Primary Examiner, GAU 2863

September 8, 2011